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**Push versus Pull Systems: A Case Study of a Humanitarian Supply Chain**

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# Push versus Pull Systems: A Case Study of a Humanitarian Supply Chain

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## Summary:

This thesis is an exploratory research that looks into how beneficial the implementation of a pull system would be for a humanitarian organization's supply chain, based on actual data provided. It also determines if the results on the inventory management are consistent with the organization's current inventory policy.



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## KEY INSIGHTS

1. Kanban can provide better management of inventories since no decision making process is needed and the emotional factor is taken away.
2. It reduces the training in the field because the process of placing an order is straightforward, which makes the transition between employees smoother due to high turnover experienced in this type of environment.
3. Cost reductions can be observed since orders are placed based on the actual demand, and waste is reduced.

## Introduction

The nature of this humanitarian Organization's project is to provide an antiretroviral treatment to HIV positive patients; thus, a reliable system is needed. This thesis aims at building a case study on the feasibility of using Kanban as a way of controlling inventory levels using one of the Organization's projects in sub-Saharan Africa, while maintaining a desirable fill rate of the medications needed to treat this disease.

The current system used by the Organization to manage demand is a push system; that is, the medical team has an estimate of the treatment and the opportunistic medicines they will need in the next

Among the benefits are that "pull systems have less congestion, are inherently easier to control, and the benefits owe more to the fact that work in progress is bounded" (Spearman & Zazanis 1990). One technique used in the pull systems is Kanban, a Japanese word that translated literally means "visible record". Within the supply chain world, Kanban is a card or any other signal used to indicate

six months. This process is a prediction of the demand, and that is what is currently ordered in anticipation of the real needs of the end users, including safety stock to respond to variability in demand and delivery time. In case there is an out-of-stock medicine, additional orders can be placed before the regular order period, which in this case is only twice a year.

Many studies point out the great benefits of pull over push systems, as described by Hopp & Spearman (2004): "A pull system is one that explicitly limits the amount of work in process that can be in the system. A push system is one that has no explicit limit on the amount of work in process that can be in the system."

the need for inventory replenishment, and thus, triggers action upstream in the supply chain.

## Kanban Model

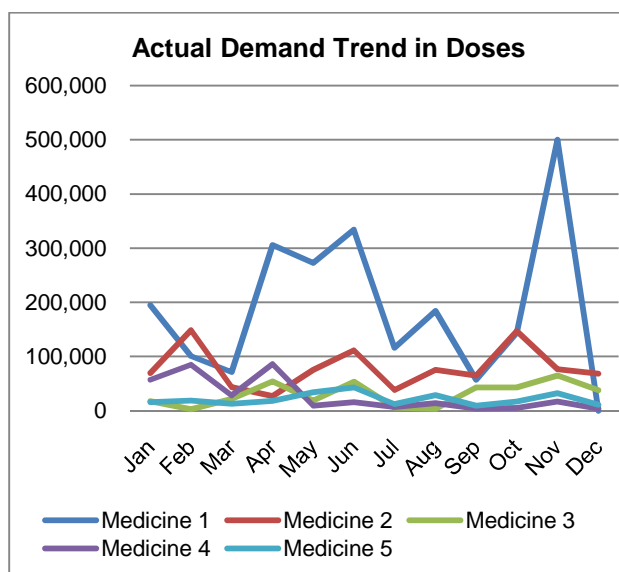
The concept of implementing Kanban in a humanitarian environment has been the focus of this exploratory research. The idea would be to have two bins in the central warehouse of the mission and in

each project. Each time the bin is empty in a project, the move card is sent to the central warehouse. The warehouse fills the bin again with the number of medicines specified in the card, and sends the bin back to the project full of medicines. In the meantime, there is another full bin that can be used by the medical team until the other one arrives. By having two bins, the amount of inventory is kept in control, and there is no need for replenishment until one of the bins is fully depleted. The same concept can be used between the central warehouse and the supply center located in France. A model in *Arena* software was used to test this concept when the demand distributions were normal, exponential, and gamma.

### Inventory Replenishment Comparison

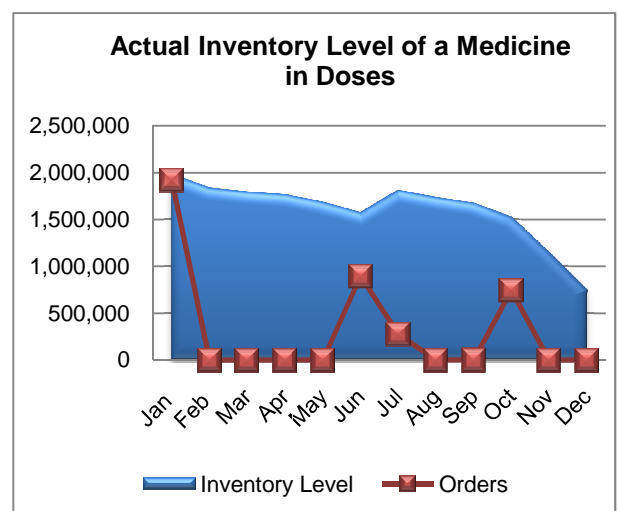
Each year a certain number of people enter the HIV/AIDS program in the mission. While in treatment, these patients have other types of diseases that also need to be treated with opportunistic infection medicines. There should be medicine in stock for these types of illness, as well as enough HIV/AIDS treatments in the inventory to meet the demand.

The project needs about 150 different items to cover the needs of their patients, which in 2008 accounted for an average total monthly demand of 595,000 units. To better understand the challenges of the supply chain, a close analysis on the variability of the demand and its distribution is needed. The following graphic shows the randomness of the demand for the top five medicines most used in the project.

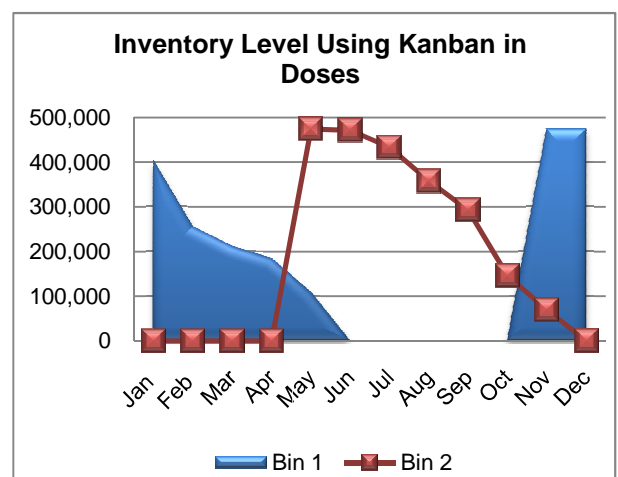


The current replenishment policy follows a periodic review where the inventory status is checked at regular periodic intervals and an order is placed to raise the inventory level to a specific threshold (Chopra & Meindl 2007). The policy the organization has in place requires the threshold of the items to be 11 months of the average monthly consumption.

Based on actual data, instead of placing only 2 medical orders per year, in 2008, a total of 12 orders were placed. From these orders, 9 were emergency shipments, and thus, sent by air, and 3 were placed by ship, as is stated in the policy. The following graphic is an example of the inventory level of a medicine used in the project and when the orders were received.



The following graphic shows what the inventory level for the same drug could be if Kanban is used with a 99% service level.

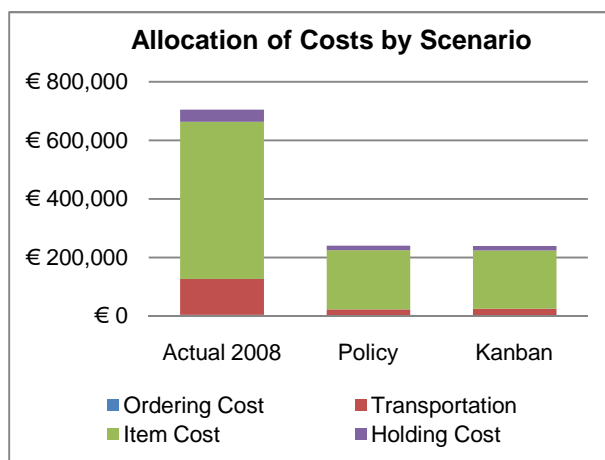


Several scenarios were done based on the ten medicines most used in the project, which represented 70% of the total demand. The scenario that showed the best fill rate using Kanban was compared with the actual replenishment of the

project. The difference in cost is shown in the following table:

	Actual 2008	Kanban	%
Orders Placed	12	8	67%
Ordering Cost	€ 3,600	€ 2,340	65%
Transportation	€ 123,252	€ 22,049	18%
Item Cost	€ 535,642	€ 199,611	37%
Holding Cost	€ 42,295	€ 14,971	35%
<b>TOTAL</b>	<b>€ 704,789</b>	<b>€ 238,972</b>	<b>34%</b>

The following is a cost comparison between the actual inventory replenishment, what the actual policy states, and what Kanban may offer for the ten most used medicines of the project.



Even if the policy and Kanban have similar costs, the research showed the medical team is not following the policy. The medical team may fear the stockout of a medicine and place an emergency order. The actual scenario does not understand the variability of the demand, the costs of the extra shipments are not analyzed, and there is poor management regarding the expiration of the medicines.

## Conclusions

Based on the data provided by the Organization, different scenarios using Kanban were done as well as a cost-benefit analysis for each one. The results showed that the pull system can work in an environment with stochastic demand and a lead time of between three and four months. In summary, some of the benefits of implementing Kanban in this environment are:

- Better management of the inventories since no decision making process is needed and the emotional factor is taken away.
- Reduction of training in the field because the process of placing an order is straightforward.

- Dependency on technology is reduced; communication between the projects and the capital will be the movement of the bins.
- Calculation of stocks is easier since the same quantity will be ordered every time, thus releasing this time for other activities.
- Smooth transition between employees due to the high turnover experienced in this type of environment.
- Cost reductions since the orders are placed based on the actual demand, and waste is reduced.

## Recommendations

The future steps proposed are the implementation of a pilot study of the top 5 or 10 medicines used in this project to test the robustness of Kanban. Things to be considered before the implementation of the pilot study are:

- Material and physical size of the bins.
- Information needed in the Kanban cards.
- Transportation of the bins between the central warehouse and the projects.
- Implementation of metrics to monitor the fill rate, total landed cost, percentage of medicines lost due to expiration date and inventory turns, among others.
- Changes in the current policy process for placing an order; the authorization process may need to be expedited to avoid delays in placing an order.

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